ARTICLE

Quantitative Discrepancy in Cerebral Hemispheric Temperature Associated with "Two Consciousnesses" is Predicted by NeuroQuantum Relations

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Abstract

NeuroQuantological principles predict that equations applicable within the microcosmic world should also be valid within macroscopic brain space. We tested the hypothesis that the human brain exists in two different energy states associated with the two hemispheres. The quantal equation $f=(E_a-E_b)/h$, where E_a is the energy of state a and E_b is the energy of state b and h is Planck's constant, and the solution for temperature from Boltzmann's constant predicted that a difference of only 1 deg C between the two cerebral hemispheres would be sufficient to produce disparities within brain space. This transient condition could facilitate the intrusions into awareness of "another consciousness" reported as a "sensed presence". The results supported our prediction. Moderate strength correlations were found between the report of a sensed presence and the increase in tympanic membrane temperature in the right ear compared to the left ear following 30 min exposure to an optimal environment that involved weak, transcerebral magnetic field stimulation whose point durations could access quantal dimensions.

Key Words: sensed presence, weak magnetic fields, tympanic temperature, hemisphere asymmetry, human experience

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Introduction

One of the essential premises of NeuroQuantology is that principles applicable to the microcosmic domain of particle-wave transitions should manifest strong correlations and order extending into the macroscopic scale of human brain space (Jibu and Yasui, 1995). As indicated by Bohm (1951) changes in states of consciousness are analogous to those of quantum states. Whenever a system can exist in either of two different energy states, a transition between these two states can be expressed in terms of a particular frequency.

That the human brain generates a consecutive string of repeating classes of electric matrices or states has been shown by Koenig et al (1999) who employed methods of dynamic, quantitative electroencephalography. The durations of these distinct microstates range between 80 and 120 ms (8 Hz to 12.5 Hz), match the minimal duration of a percept (Efron, 1970), and have been hypothesized to correspond to the

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basic blocks of human informational processing. According to Koenig et al (2002), there are primarily four classes of microstates that are manifested in different temporal proportions during the person's life time. Two of these states involve diagonal polarities that cross from one cerebral hemisphere into the other.

Transition states can be quantified according to the Einstein Relation (see Burke, 1985) as the frequency (f) $=(E_a-E_b)/h$ where E_a is the energy of state a, E_b is the energy of state b and h is Planck's constant of 6.6×10^{-34} J s. Frequency can then be converted into the spatial distance or wavelength between the two states by dividing this value into the velocity of light. If there are 8.317 J/K mol (the gas constant) and 6.023×10^{23} particles or molecules per mol, then energy per deg K is 1.38×10^{-23} (Boltzmann's constant). The energy displayed by the particle would be this constant multiplied by the temperature.

For a difference of only 1 deg C at biological temperatures, such as 311 deg K (429.2×10^{-23} J) and 310 deg K (427.8×10^{-23} J), or the transition between 37 deg C and 38 deg C, the energy would be 1.4×10^{-23} J. When divided by Planck's constant, the resulting frequency would be 0.2×10^{11} Hz. The associated wavelength is $(3 \times 10^8$ m/s)/0.2×10^{11} Hz or 15×10^{-3} m or 1.5 cm. Hence a change of only 1 deg C would produce, if this concept is applicable to the macroscopic level, a translocation of the electromagnetic matrices of consciousness by about 1.5 cm.

This distance is about the width of the longitudinal fissure that separates the two cerebral hemispheres of the human brain. This distance is also similar to the separation of foci within the cerebral regions activated by expression of either one of two languages (Kim et al, 1997) in bilingual individuals. Their brains could be considered systems that can exist in either of two different energy states.

That consciousness might be described by interactions between the classical and quantum world has been also suggested by Jibu and Yasue (1995). If photon emissions from homeothermic states within the brain are actually the source of the images of dreams, as postulated by Bokkon (2005), then a connection between the energy associated with action potentials of neurons and photon quanta must exist.

Reductionism would not be required. There are multiple levels of spatial and temporal organizations within the brain's volume, each with their own emergent properties. Their necessary intercorrelations could easily be misinterpreted as casual. For example, the phenomena of thought might be correlated with action potentials but really caused by photon quantal processes that are required for these macroscopic electromagnetic events.

From this perspective the operational range of magnetic intensity of about 1 pT (picoTesla) for the human brain (Anninos et al, 1991) becomes important and the product of the spin (magnetic moment) of an electron (9.28747×10^{-24} J/T) and 1×10^{-12} T which is 9.28747×10^{-36} J or 1×10^{-52} kg as a mass equivalent becomes relevant. This value has recently been shown to be the upper limit of the rest mass of the photon (Tu, Luo, and Gillies, 2005). Spin has been considered the most important of the four quantum numbers, which describe the unique quantum state of an electron, for determining location of particles. Thus, even at the simplest level there is a rational connection between the state of particle-wave as well as the domains of quantum phenomena and human thought as predicted by Neils Bohr (1958).

The macroscopic equivalent to transition states within cerebral functions (and correlative experiences) should be testable within the experimental setting. For the last thirty years we have been investigating the neurophysical bases of the variants of phenomena frequently labelled "double consciousness" or "mental diplopia" that have been reported in all human cultures. The experience is usually described as a sensed presence. It is often attributed with the properties of "sentience", profound affect, and expanded spatial-temporal boundaries.

We (Persinger, 2003; Persinger & Makarec, 1992) have hypothesized the experience of the sensed presence to be the right hemispheric equivalent of the left hemispheric sense of self (Silberman & Weingarten, 1986). Whereas traditional left hemispheric linguistic processes are associated with the sense of self, perhaps the modern analogue of "cogito ergo sum", the homologous right hemispheric processes could be experienced as another consciousness (Harrington, 1995; Jaynes, 1976).

The labels for this "other consciousness" have ranged from Hughlings Jackson's "parasitic consciousness" for temporal lobe patients (Bancaud et al, 1994; Bear, 1986) to Muses, gods,

demons, and alien visitations in normal people (Evans, 1984). The affective components of these experiences may be so powerful that the person may contravene the mores of the society because of the belief that cosmic consent has been granted by the "presence".

Our working model (Persinger, 1993) has been that a relative increase in right hemispheric dominance under optimal condition would allow "intrusions" of these experiences into left hemispheric awareness (Booth et al, 2005). These transient intercalations and the intrusion of these right hemispheric processes would be experienced as a "sensed presence" with correlative mystical states (Kurup & Kurup, 2003). If this hypothesis were valid, then an increase in temperature within the right hemisphere, as inferred by tympanic membrane thermometry, would be significantly correlated with these experiences.

Changes in brain temperatures and tympanic temperatures are closely related (Mariak et al, 1994). Differential temperatures within the left and right ear have been associated with the hemispheric specificity of different tasks (Swift & Perlman, 1985; Cherbuin & Brinkman, 2004). Sensitivity of neuronal function to small changes in central temperature have been shown empirically. For example, cells within the hypothalamus are sensitive to temperature changes as small as .01 deg C (Tromp, 1963). Subtle alterations in brain temperature are strongly correlated with changes in electroencephalographic activity and power (Bokkon, 2005).

Mild fevers might encourage these experiences, particularly for individuals who exhibit slightly greater right hemispheric dominance. That epidemics of sensed presences could change the fabric of a society by affecting cognition should not be underestimated. For example during the Justinian Plague in 542 C.E., the first known pandemic of bubonic infection, the symptoms began with a mild fever that lead to feelings of "presences" and "apparitions" that people concluded lead to death if they were touched by the phenomena (Kohn, 2001). This resulted in an epidemic of fear, personal isolation, and social disintegration.

A quantal, neurobehavioral approach to understanding the bases of these phenomena could help develop explanations and strategies to prevent such erroneous attributions. Our prediction for the threshold of the amount of increase in temperature (1 deg C) within right hemisphere compared to the left to promote the conditions that produce the report of the "sensed presence" was derived from "quantum" physical neuroscience (Eccles, 1986; Hameroff, 1987; Penrose, 1989; Umezawa, 1993; Jibu and Yasue, 1995; Persinger & Koren, 2007).

This solution has direct medical implication. The sensed presence is often encountered in complex partial epileptic patients who have asymmetric electrical patterns within the right compared to the left hemisphere due to structural (Landtblom, 2006) or functional anomalies. The sensed presence is also reported by more than 80% of some clinical populations who have sustained mild head trauma (without the loss of consciousness) and who display increased proportions of partial complex epileptic-like experiences and right hemispheric indicators for mild neuropsychological anomalies that would be conducive to electrical transients within that hemisphere (Persinger, 1993; 1994; Persinger and Makarec, 1993; Roberts et al, 1990).

The experience of a sensed presence, which we hypothesize requires about 1 deg C difference between the two cerebral hemispheres, can occur naturally and spontaneously throughout the population. However to facilitate this translocation or "separation of consciousness" in normal people and within an experimental setting where variables can be more effectively controlled we have developed a procedure by which a gradient of the static magnetic field is induced across the two cerebral hemispheres to be equivalent to about 70 nT/cm (Persinger, 2006). The effective gradient at the level of the width of a neuron (10 um) would be about 70 pT. Even assuming an approximately 100 fold attenuation within the brain the resultant value would be within the pT range that is considered the intensity profile for brain function (Anninos, et al, 1991; Jacobson, 1994).

Finally, the characteristics of the sensed presence are similar to the "hidden observer" phenomenon (Hilgard, 1984). It has been employed to explain information (for example the solution to a problem) that is acquired during a "hypnotic state" and then "forgotten" during the normal state. This phenomenon has been attributed to right hemispheric functions (Harrington, 1995). These experiences are similar

(Persinger, 1979, 1988, 2001) to the subjective experience of a "presence" or sentient power that is frequently associated with the sudden acquisition of information that is considered independent of the experient's reinforcement history. Still other researchers have considered this process the source of creativity.

To assess the contribution of suggestibility, either as a confounding factor or as a contributing variable to the sensed presence, this capacity was also measured directly by the Hypnosis Induction Profile (Spiegel & Spiegel, 1978). The changes in this profile were taken after 30 min of exposure to an experimental setting designed to promote increased activity within the right hemisphere. We predicted that: 1) there would be a positive correlation between increased temperature within the right ear relative to the left within an optimal setting and the report of a sensed presence, and 2) the threshold for this increase would be about 1 deg C based upon the application of quantal functions from the Einstein Relation.

Method

Subjects

After review and acceptance by the department's Human Ethics Committee, a total of 28 (14 men, 14 women) first year university students, aged 19 to 25 years of age, volunteered as subjects to be involved in a hypnosis study. All preferred their right hands for writing. Each received a bonus mark of 2% to their final grade in a first year psychology course for the participation. The sample size was selected on the basis of the expected effect size of the phenomenon (St-Pierre & Persinger, 2006).

Apparatus

A Braun infrared thermometer (accurate to 0.1 deg C) was used before the experiment began and immediately after it was finished 30 min later. The experimental (industrial echoic) chamber, employed to simulate a cave, was 2.74 m x 2.54 m x 1.98 m (high). When the double doors were closed circulating fans were activated. The average values within the space where the subject's heads were located and facing approximately geographical east for the various components of the earth's magnetic field, as measured by a MEDA FM-300 vector magnetometer, were: X (facing geographical eastward): 5,065 nT, Y: 2,020 nT, vertical (Z): 22,200 nT, resultant: 22,860 nT, declination -140 deg (SE-S) and inclination 73.8 deg. In comparison these values in the control room outside of the chamber were: X: 8,300 nT, Y: 8,750 nT, Z: 41,680 nT, and resultant: 43,380 nT with an inclination of 73.8 deg. For comparison the average intensity of the resultant field more than 30 m outside of the building ranged between 49,000 nT and 51,000 nT which is within the expected range for this latitude (Campbell, 1997).

The strengths of the static field within the modified motor cycle (Koren) helmet (see http:www.laurentian.ca/behavioral neuroscience for picture) worn by each subject were designed to be asymmetrical for the space in which the left and right hemisphere would be located. The helmet contained four pairs of solenoids. Each solenoid was connected to a matched solenoid on the other side of the helmet such that when the pair was activated the magnetic field was generated through the space occupied by the subject's brain. The solenoids were actually modified reed switches each containing a small iron nail. The cluster of four solenoids were embedded in the helmet at the approximate level of the temporal/parietal lobes for most people. Switches controlling the circuits on each side of the helmet allow enhanced current and greater strength magnetic fields on either side of the helmet.

By activating the right side for more than about an hour, residual static magnetic fields were induced within the solenoids that remain relatively constant for at least a week. We reasoned that this gradient in the intensity of the magnetic field within the helmet favoured the right hemisphere such that the function vector (a type of inner product space) of the static magnetic field would be towards the left hemisphere. Metaphorically at least this could encourage the intrusion of right hemispheric processes into left hemispheric awareness (Persinger, 1993; 2003).

The values for the magnetic field strengths were measured by moving the sensor with its long axis oriented in the rostral-caudal plane within the helmet and stabilized in the same plane occupied by the temporal/parietal lobes in 5, 5 cm increments (width of sensor for the magnetometer is 2.5 cm) from the left to the right side of the helmet. The values (in nanoTesla) for the left-right, rostral-caudal, and vertical vectors

as well as the resultant strengths are shown in Table 1. Declination with respect the direction faced by the volunteer and the inclination of the geomagnetic field inside the chamber, are also shown. Note that although the declination of the geomagnetic field is E-SE within the chamber, the direction inside the helmet is more directly east.

Table 1. Intensities (in nanoTesla) and degrees of various components of the earth's static magnetic field within 5 cm increments of space from the left side to the right side within the helmet worn by subjects to facilitate the sensed presence.

Component	Left(1)	2	3	4	Right(5)
Left-Right	3132	2351	2026	2774	4311
Rostral-Caudal	2710	2511	2839	2606	2041
Vertical	20043	20711	21063	21903	22949
Declination	-51.2	-40.9	-35.7	-46.7	-64.6*
Inclination	78.6	80.1	80.6	80.0	78.0
Resultant	20439	21017	21347	21903	22949

* -90 would be magnetic east direction

Procedure

The procedure was similar to that administered to our last approximately 1,000 subjects tested over the last 20 years (Persinger and Healey, 2002). The subjects were tested over a three month period with no more than two subjects tested any given night. All subjects were tested between 18 hr and 20 hr local time. Each subject entered the laboratory, signed the consent form, and was asked to sit in a comfortable arm chair that was housed within the acoustic chamber. Within two minutes Spiegel and Spiegel's (1978) Hypnotic Induction Profile (HIP) was administered. It is composed of 12 distinct measures, each ranging from between 0 and 2 or 0 and 4, plus an induction score (0 to 10). Test re-test correlations are between .76 and .80 (Spiegel and Spiegel, 1978). The HIP score is correlated about 0.70 with a cluster of items from a psychometric inventory by which temporal lobe sensitivity is inferred and with the proportion of alpha rhythms over the temporal lobes (Persinger and Makarec, 1993).

Left and right ear temperatures were recorded following the suggestion of Childs et al (2006) with the infrared thermometer. For half of the numbers of subjects the left ear was recorded first and for the other half of the numbers of subjects the right ear was recorded first for both the baseline and post-baseline measures. The modified helmet, described previously (Persinger & Healey, 2002), which contained four solenoids on each side, was then placed on the subject's head. During the next 30 min the subjects were exposed to either the sham field or to a burst-firing field that was generated between each of the four pairs of solenoids. During this period the subjects were <u>not</u> blind folded (as in previous studies) but exposed to low illumination, red, green, or white light delivered by two 40 watt bulbs within two small lamps placed about 1 m away on both sides of the subject.

Each pair of solenoids was activated for 0.5 sec such that one complete rotation of the applied field occurred in 2 sec (0.5 Hz). The burst-firing field was generated from computer software through a custom-made digital to analogue converter (DAC). The point duration of each of the 239 points (total duration .717 sec) that constituted the burst pattern was 3 msec and the time between bursts was 4 sec. The 3 msec point durations have been selected because of their quantum significance (Persinger and Koren, 2007). The burst firing pattern, whose shape has been published elsewhere (Martin et al, 2004), was selected because it is associated with pleasant experiences and during whole-body exposure in rats produced analgesia equivalent to 4 mg/kg of morphine.

In the plane of the right-left hemisphere the average peak-to-peak amplitude of the burst-firing pattern was 5300 nT over the right hemisphere and 3300 nT over the left, resulting in a difference of 2000 nT (2 microT) between the two sides. This meant that when the burst-firing field was activated the intensity of the magnetic field over the right hemisphere was about 1 microT stronger than the static field and traversed, during its peak to peak variation, the extent of the discrepancy between the left and right sides of the brain.

We reasoned that this superimposition of physiologically-relevant burst firing fields upon the pre-existing static gradient with a similar range of intensity should enhance the condition that would "split" the field or matrix (analogous to a Zeeman effect) associated with consciousness and encourage the sensed presence (Booth et al, 2005). Similar superimposed complex magnetic fields have been shown to enable animals to employ static geomagnetic field gradients as sources of information (McKay & Persinger, 2005)

and to influence modified neuromatrices (McKay & Persinger, 2006) at least in rats.

At the end of the 30 min exposure the helmet was removed and the second measurements with the thermometer were recorded. The subject was administered the HIP immediately and then instructed to complete the exit questionnaire. It contained 20 questions concerning experiences and 16 items concerning the sensory locations and emotional features of the experiences (Persinger, 2003). For the present experiments the ranking of incidence of various experiences including the sensed presence as well as the relative location of various visual experiences that included nominal (no, yes) answers for three separate items about visual sensations were within: the upper visual field, left visual field, or right visual field were utilized.

From the four temperatures for the left and right ear for before and after the 30 min exposure to the helmet the following variables were calculated: 1) the difference between the right and left ear for the baseline measure, 2) the difference between the right and left ear for after 30 min, 3) the difference between the latter two, i.e., right-left difference from after minus right-left differences during baseline, and 4) the ratio of the latter difference divided by the difference at baseline. The total score for the HIP before the exposure were subtracted from the HIP score after the exposure. This net difference as well as the relative difference (ratio) was calculated. Analogous values were obtained for changes in temperature within the chamber.

These variables were correlated (Spearman rho, and Pearson r) with the report of a sensed presence as well as the ratio of the latter. This value was the score for the sensed presence divided by the mean of scores for all 20 items for various experiences to control for non-specific effects or generalized increases in experiences. Partial correlations for net and relative changes in the temperature within the room were completed. The scores for sensed presences as well as the various measures of tympanic temperature were also assessed by analyses of variance as a function of the presence or absence of the experimental burst-firing magnetic field and gender. There were no significant differences between the three colors of low level illumination for any of these measures so this variable was not considered. All analyses involved SPSS software on a VAX 4000 computer.

Results

The hypotheses that the report (and presumably experience) of a sensed presence would require an increase of 1 deg C in the right hemisphere compared to the left was supported. The Spearman correlation between the net increase in right ear compared to left ear temperature and the relative sensed presence (to control for non-specific responding) was rho=.65 ($p < .001$). The slope (standard error of the slope in parentheses) of the relationship between the rating of the absence or the presence of a "sentient being" and the change in the inferred brain temperature was .85 (.27). This value is within the error of measurement range for the predicted value of 1 deg C.

The only treatment effects were for: 1) the increased ratio in change in tympanic temperature of the right ear as a function of exposure to the burst-firing magnetic field or sham field, 2) a decrease in net change in the right ear temperature for women compared to men, and, 3) the decrease ratio of change in room temperature for those exposed to the burst-firing magnetic field vs the sham fields. There were no statistically significant main effects or interactions for the other measures for ear temperature, room temperature, change in hypnotizability, or reports of sensed presence. Consequently the means and standard deviations for the various measurements for both groups combined are shown in Table 2.

Table 2. Means and standard deviations for various measures for all subjects (n=28)

Measure	Mean	SD
Temperatures of Chamber		
before	19.8	0.8
after	21.1	0.5
net change	1.3	0.6
rel change	.7	0.3
Ss' Left Ears		
before	36.7	0.5
after	36.7	0.5
Ss' Right Ears		
before	36.6	0.6
after	36.7	0.6
Ss' Left-Right Ear Differences		
before	-.11	.34
after	-.03	.34

net change	.08	.38
rel change	-.50	1.80
HIP (Hypnosis Induction Profile)		
before	7.4	2.5
after	7.6	3.0
net change	.2	1.8
rel change	.04	.34
Experiences		
Presence	.43	.63
Relative pres	.65	1.13

The subjects exposed to the burst-firing field displayed a significantly [F (1,30) = 7.23, p<.01; omega-squared estimate=25% of variance explained) greater increase (M=.4, SD=1.3) in the ratio of the temperature within the right ear to left ear differences compared to those who did not receive the burst-firing field (M=-1.3, SD=1.8). Initial covariance for the change in temperature within the chamber did not alter the significance or magnitude of this effect.

The females showed a significant [F (1,30)=5.54, p<.01; omega-squared estimate=16%] decrease (M=-.08, SD=.35) in the net change of right-left temperature relative to baseline 30 min later compared to the males (M=.22, SD=.38). Initial covariance for change in temperature within the chamber did not change this sex difference. For the group exposed to the burst-firing field the ratio of the room temperature decreased (M=.05, SD=.02) significantly [F(1,30)=4.45, p<.05] compared to those who received no burst-firing field (.08, SD=.02).

The Spearman rho correlations between the incidence of sensed presence and relative sensed presence and the various variables were: net increase in temperature in the right ear (rhos=.60; .65 p<.001), proportion increase in right ear temperature from baseline (rhos=.11, .20 n.s.), change in HIP scores (rhos= -.29, n.s., -.35, p <.03) and images along the left side of the visual field (rhos=.48, .47, p<.01). Pearson *r* values were comparable in magnitudes.

Partial correlations controlling for the shared variance between change in the HIP score and the sensed presence and the change in temperature did not alter the magnitude of the relationship between the latter two variables (partial r (25) =.51, p<.01). Symmetrical partial correlations with all other combinations did not yield any statistically significant results. Partial correlation controlling for the change in chamber temperature during the 30 min did not change the magnitude or the level of the statistically significant association between the net increase in temperature within the right side of the brain and the incidence of sensed presence.

The correlations (rho) between the two measures of sensed presence and the various variables for the groups that received the burst-firing field or the sham field separately are shown in Table 3. Both groups showed the significant correlation between net increase in temperature within the right hemisphere compared to the left and the incidence of sensed presence. For the group exposed to the burst-firing field the incidence of sensed presence decreased with increased hypnotic induction scores over the 30 min of exposure. For this group only the visual experiences during the exposure were subjectively lateralized to the left visual field.

Table 3. Spearman rho values for correlations between the two measures of sensed presence (absolute score and relative score compared to all other experiences) and various changes in tympanic temperature, room temperature, hypnotic induction profile, and lateralization of visual images during the 30 min exposure to the sham or burst-firing magnetic fields.

Variable	Sham Field (n=14)		Burst-Firing (n=14)	
	Absolute	Relative	Absolute	Relative
Ear Temperature				
R-L dif baseline	.14	-.07	.10	.26
R-L dif after	.82***	.85***	-.35	.51*
Net dif	.69**	.73***	.50*	.58**
Relative change	-.21	.09	.24	.41
Room Temperature				
Baseline	-.28	-.32	-.17	-.13
After	-.17	-.24	.12	.10
Net dif	.21	.19	.33	.22
Rel change	.23	.21	.29	.21
HIP Score				
Baseline	.08	.13	.05	-.11
After	.14	.09	-.34	-.45*
Net dif	-.03	-.12	-.63**	-.62**
Rel change	-.07	-.16	-.63**	-.61**
Visual Experiences				
peripheral	.02	.15	-.16	-.22
upper field	.30	.16	-.02	.12
left side	.32	.20	.61**	.73***
right side	.02	.02	-.16	-.18

* p<.05, **p<.01, ***p<.001

Discussion

Consciousness has been argued to be the interaction between the classical and quantum world (Jibu and Yasui, 1995). The sensed presence,

the feeling of proximity of another "consciousness", is one of the most frequent experiences reported by humans during conditions that are often considered "mystical", creative, spiritual, and even religious (Evans, 1984). The classical Greeks attributed "visitation by the Muses" as the source of creativity for music, art and even science (Persinger & Makarec, 1992). The results of the present experiment are consistent with the hypothesis (Persinger, 1993; 2003) that this neurocognitive phenomenon under optimal conditions may be generated by brain activity correlated with a temperature discrepancy as small as 1 deg C between the right (higher) and left hemisphere.

The slope of about 1 deg C indicated that this increment of increase was sufficient to shift subjective reports from no experience to the experience of a presence. The correlation was only significant with the actual change in temperature, as would be expected from a mechanism coupled tightly to a dynamic physical process such as a shift between two states, rather than the ratio of change from baseline. At least 25% to 50% of the variance in the report of sensed presences was accommodated by this increase in temperature. The absence of contribution from changes in room temperature to this effect would suggest the phenomena is robust and of sufficient magnitude to begin examining a range of variables that might influence it.

There is a strong association between changes in temperature within the ear and within the brain (Mariak et al, 1994). However Cherbuin and Brinkman (2004) have shown that decreased temperatures were associated with increased activation of the hemisphere as inferred by functional Magnetic Resonance Imaging (fMRI). If their interpretations are generalizable then the moderately strong positive correlation between increased temperature within the right ear compared to the left and the report of sensed presence we observed would suggest a relative decrease in right hemispheric activation.

Because most intracortical neurons are inhibitory, a non-linear mild decrease in activation might allow a narrow band of disinhibition to occur that could allow a transient awareness of the "sensed presence". As predicted by the vectorial hemisphericity (Persinger, 1993) this anistropy could be produced by a relative decrease in left hemispheric activity. Patients who are prone to "ego alien intrusions" from right hemispheric processes, often labelled as conversion disorders, show diminished flow within the left hemisphere (Yazici & Kostakoglu, 1998).

A classical counterargument is that the relationship between the sensed presence and the 1 deg asymmetry in hemispheric temperature simply reflects gross neuronal activity at a macroscopic level, not a transition of quantum states. However if experience and consciousness are the manifestation of changes in larger aggregate states that display quantum properties, then the 1 deg change must represent a threshold for either the number or density of photons required to shift between waves and particles to produce the experience.

Suggestibility does not explain the production of the sensed presence within controlled experimental settings (Granqvist et al, 2005; St-Pierre & Persinger, 2006). In fact in the present study the group exposed to the burst-firing magnetic field showed a significant and negative correlation (rho=-.63) between the change in the subjects' hypnotic induction profile and the report of sensed presences. The experimenter was not aware of the purpose of the study; consequently it is unlikely this association was confounded by a subtle bias in the administration. The result that subjects who showed the greatest increase in hypnotizability within the field reported *fewer* sensed presences would be congruent with the hypothesis that both phenomena (Hilgard, 1984; Harrington, 1995) reciprocally share a third factor or source of variance involved with the right hemisphere that was activated by the stimulation.

That the burst-firing field affected the right hemisphere more than the left in this study would be supported by the strong positive correlation between the report of sensed presences and visual experiences attributed to the left but not right visual peripheral fields. This correlation was not statistically significant for the group exposed to the sham field. It may be relevant that increased geomagnetic activity has been associated with increased visual sensations along the left peripheral visual field in several settings and suggests a specific sensitivity of the right hemisphere to applied natural (Belisheva et al, 1995) or experimental weak magnetic fields (Booth et al, 2005).

The results of the present experiment strongly support the assumption that the principles of NeuroQuantology can be studied within the laboratory and tested by direct experiment. The precise numerical value for the slope showing a 1 deg discrepancy in hemispheric temperature was associated with the sudden occurrence of the "other state", experienced as a sensed presence, was predicted from Einstein's Relation (the transition between two states can be expressed by a particular frequency which is equal to the difference in energy between the two divided by Planck's constant) that had previously been applied to particle-wave transitions. We suggest that the future development of both neuroscience and psychology would benefit from the systematic and open-minded application of quantum principles.

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